Analysis of Deuterium Scattering on ^{6,7}Li up to 50 MeV based on Realistic Effective NN Interaction

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The double-folding (DF) model [1,2] of the deuterium-nucleus optical potential has been involved within a semi-microscopic analysis of the elastic scattering of deuteron on ^{6,7}Li for energies up to 50 MeV, of interest for the calculation of the D-Li neutron source term [3]. The direct and exchange real parts of the microscopic real optical potential, including nucleonic and mesonic form factors, are given in terms of the projectile and target nuclear densities respectively, which are folded with a realistic effective NN interaction [4]. The deuteron density distribution has been obtained from the Machleidt [5] S wave function while for the target nuclei ^{6,7}Li we have used a gaussian form with parameters obtained from either the analysis of the electron scattering data of Bray et al. [6] for ^{6}Li, or the shell model calculations by Satchler and Love [1] for ^{7}Li. The Paris M3Y effective interaction [7] has been chosen for consistency with the deuteron density distribution. Finally, the real DF potential has been applied for description of the deuteron scattering data from 1 to 50 MeV, in conjunction with appropriate Woods-Saxon imaginary and spin-orbit potentials by using the code SCAT2 [8] modified to include the DF potential. No adjustable parameter or normalization constant of the DF real potential was involved in this work. The comparison of the calculated results with the bulk of experimental elastic scattering angular distributions for the ^{6,7}Li nuclei has provided imaginary surface and spin-orbit potential parameters for the various incident energies. Moreover, their average values have made possible the establishment of energy-dependent phenomenological imaginary and spin-orbit potentials for the interaction of deuterons with the Li isotopes. Altogether the results of this analysis support the concept to reduce the phenomenological part for the potentials to describe deuteron scattering data by the use of microscopic calculations. Further work concerns the adjusting only the real phenomenological potential parameters while the imaginary and spin-orbit components remained unchanged, in order to provide a full average parameter set which can be more easily used in further analyses or still missing predictions of deuteron interaction with ^{6,7}Li. On the other hand additional experimental data to guide and benchmark the model calculations at incident energies above 15 MeV, where only two measurements exist up to 50 MeV, are strongly requested.

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